Space Weather Technical Forecast

Issued on Sunday, 24 December 2023 at 01:01 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-class flares throughout.
Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with only low level C-class flaring. There are eight sunspot regions on the visible disc, with ex-AR3519, a previously active region rotating across the western limb. AR3528 and AR3530 exhibited tenuous and transient delta regions, but have both since simplified. AR3529, the largest region on the disc is mature and stable. All the remaining regions are either stable or in a declining phase.

There are a number of filaments on the disc, but no Earth-directed CMEs have been observed on available imagery through the last 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds speeds are close to back ground at 350-400km/s in a benign solar wind environment with density below average. The total magnetic field, IMF, has been weak, with the north-south component also varying weakly. Phi angle was predominantly positive (away from the Sun). Geomagnetic activity has been Quiet.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels.GOES16 high energy (greater than 2MeV) electron flux peaked at high levels before falling, with a peak of 1790pfu at 22/1525UTC. The 24-hour fluence tracked mostly level just below the Active threshold (1e8 integrated pfu) but has started to decline more significantly, falling to 4.05e7 integrated pfu by 24/0000UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Low activity is forecast, with a slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast. No coronal hole high speed streams are expected to connect with the Earth, with solar wind speeds at ambient levels. Geomagnetic activity is forecast to be at Quiet levels throughout.

Energetic Particles / Solar Radiation: GOES16 high energy proton flux is at background levels and expected to remain at similar levels. There is a slight chance of solar radiation storms, should there be any larger flares on the western side of the disc. High energy electron flux is expected to show a gradual decline from current diurnally high levels, with a decreasing chance of electron fluence reaching active levels.

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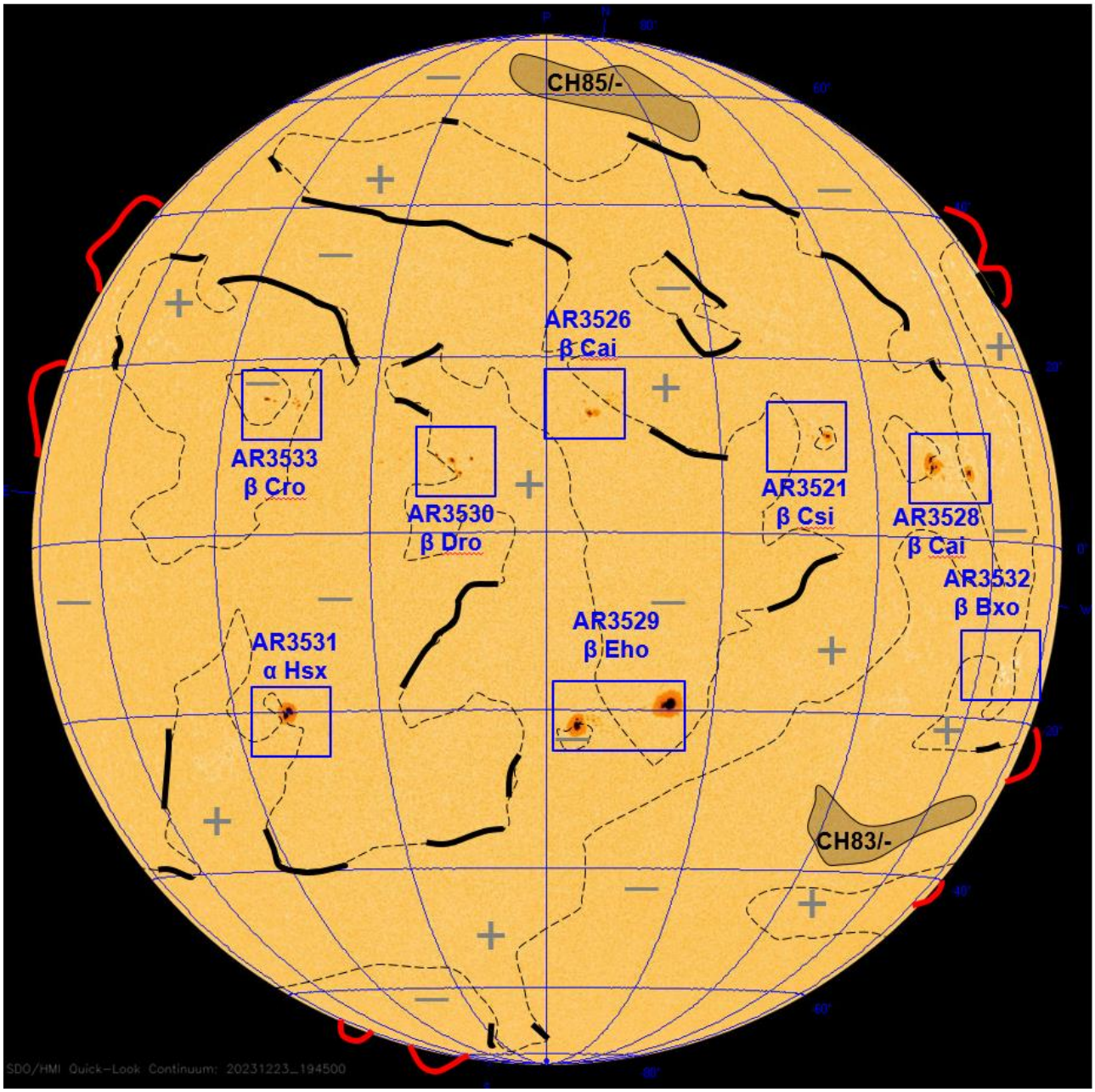
Figure 1. Solar Analysis Valid 23/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are forecast through the next four days.

No coronal hole high speed streams are expected to connect with the Earth during the forecast period, with any high speed stream from coronal hole 83 now not expected to affect Earth. Geomagnetic activity is forecast to be Quiet, with isolated Unsettled periods.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X-Ray Flares:

There are eight sunspot regions on the visible disc. AR3528 and AR3530 passed through a brief period of growth where they exhibited weak and transient delta spots, but have now faded back to beta regions. AR3519, which was a previously active region has now rotated beyond the western limb, with a decrease in risk from flares emanating from this region by 24 December. The remaining regions are either small and stable or declining. No further regions are developing, or forecast to rotate onto the disc from the far side.

Low solar activity is forecast, with a diminishing risk of Moderate activity.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	30	30	20	20
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 2: AR3528 which has simplified slightly after developing a weak delta spot in the trailer portion.

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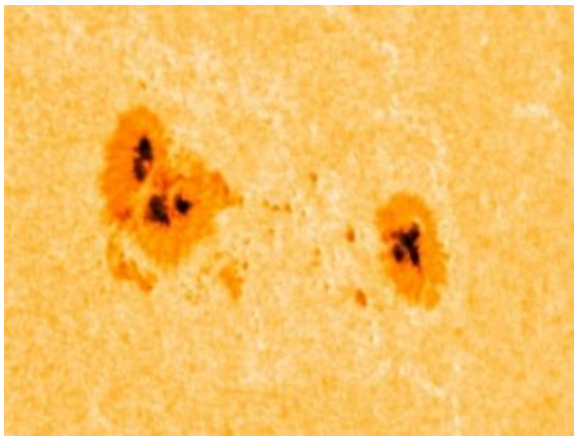
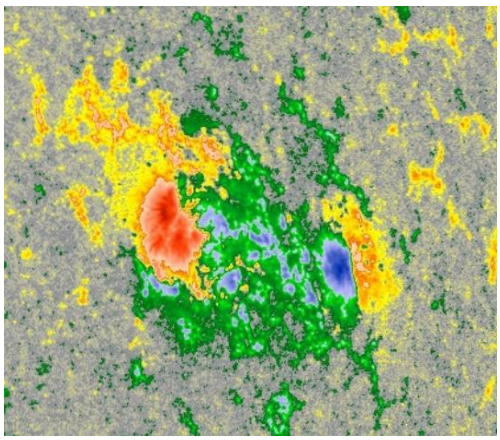
Met Office Space Weather Technical Forecast





Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is at Background levels and is most likely to remain at similar levels.

There is a slight chance of minor solar radiation storms throughout, initially from AR3519, and then from a succession of modestly complex sunspot groups rotating to the western hemisphere, maintaining a low risk through to the end of the forecast period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is oscillating on a diurnal cycle, but with a declining trend in the peaks. This decline is expected to continue through the forecast period, with no obvious mechanism for significant recharging of the electron belts.

Electron fluence appears now to have peaked, and with a declining trend in electron flux is expected to also decline through the forecast period, staying well below the Active (1e8 integrated pfu) threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)

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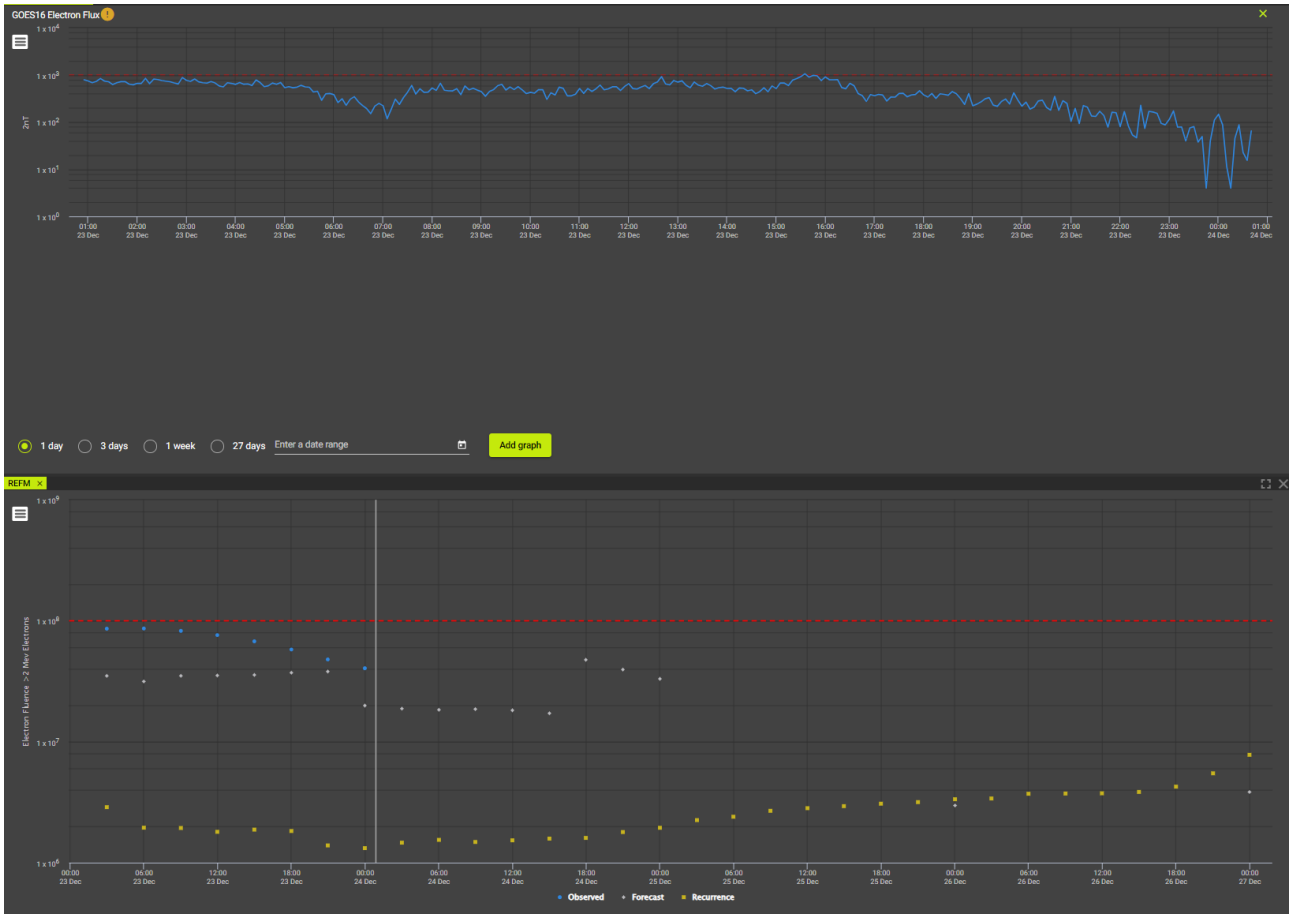
Active	**≥ 2 MeV ≥ 1x10^8**	No	10	1	1	1
Very Active	**≥ 2 MeV ≥ 1x10^9**	No	1	1	1	1

Figure 3: GOES 16 electron flux and MOSWOC REFM electron fluence



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